BONeS Input Traffic Generators

Network Research Group

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Technical Report # 90-47

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Contents

1 Introduction

This document lists all traffic models for data, voice and video sources. These mathematical models have been verified with actual measured data and their accuracy has been validated. They are described and explained in **Survey of Traffic Control Schemes and Protocols in ATM Networks** by Bae and Suda.

The models are implemented in BONeS[1] at UC Irvine.

2 Data Sources

The arrival process of an input data traffic is implemented by a geometric arrival process (discrete time case) or by a Poisson arrival process (continuous time case). The following data traffic generators are included in this release:

1. Discrete Time Single Data Generator
2. Discrete Time Batch Data Generator
3. Continuous Time Single Data Generator
4. Continuous Time Batch Data Generator

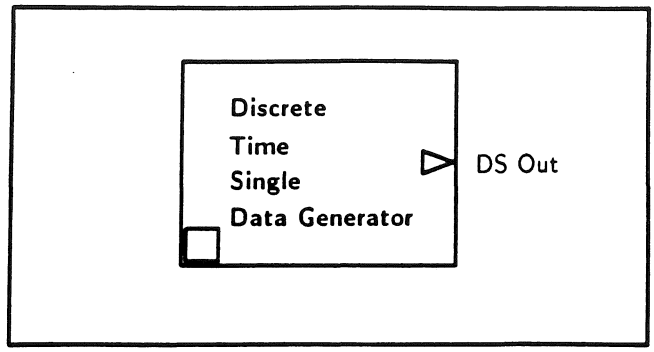
[1] Block Oriented Network Simulator and BONeS are trademarks of Comdisco System, Inc.

2.1 Discrete Time Single Data Generator

Modules in this section

- Discrete Time Single Data Generator
- Discrete Time Pulse Train
- Discrete Time Interval Generator
- Slot Time
- Geometric Rangen - Param

Discrete Time Single Data Generator



Description

This module is a Discrete Time traffic generator for single data arrivals which generates a series of trigger signals with a geometrically distributed interpulse time.

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: DS Out COMPOSITE

Description:

Output data cells are emitted with Geometric interarrivals.

Parameters

Name and Type: Prob. for Geometric Rangen REAL

Description:

This is the probability for Geometric Rangen to generate the number of cells for the time interval ($Prob = \frac{1}{Mean\ Number\ of\ Cells}$).

Name and Type: Transmission Rate (bits/sec.) REAL

Description:

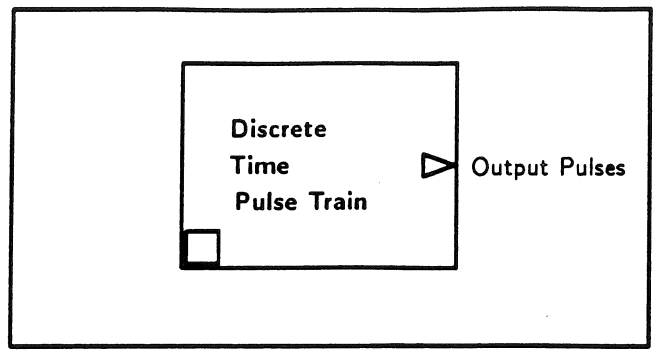
Transmission rate of the network in bits/second.

Name and Type: Slot length (bytes) REAL

Description:

The length of each slot in bytes.

Discrete Time Pulse Train



Description

This module generates a series of signals with a geometrically distributed inter-pulse time. After the first pulse, the time between pulses is generated by Geometric random number generator with a mean value set by the user and a slot time.

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: Output Pulses TRIGGER

Description:

Output which is triggered at random times according to the parameters.

Parameters

Name and Type: Prob. for Geometric Rangen REAL

Description:

This is the probability for Geometric Rangen to generate the number of cells for the time interval ($Prob = \frac{1}{Mean\ Number\ of\ Cells}$).

Name and Type: Transmission Rate (bits/sec.) REAL

Description:

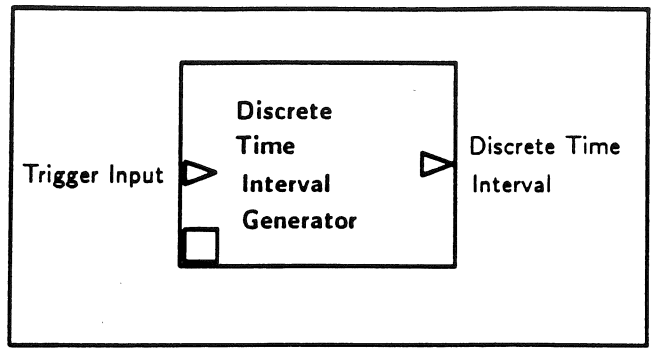
Transmission rate of the network in bits/second.

Name and Type: Slot Length (bytes) REAL

Description:

The length of each slot in bytes

Discrete Time Interval Generator



Description

This module generates the time interval for the discrete time case according to the geometrically distributed number of cells and slot time.

I/O Pads

INPUT SIGNALS:

Name and Type: Trigger Input TRIGGER

Description:

This input triggers the generation of Time Interval for the discrete time case.

OUTPUT SIGNALS:

Name and Type: Discrete Time Interval REAL

Description:

The output of the Discrete Time Interval Generator in terms of time (in seconds).

Parameters

Name and Type: Transmission Rate (bits/sec.) REAL

Description:

Transmission rate of a network in bits/second.

Name and Type: Slot Length (bytes) REAL

Description:

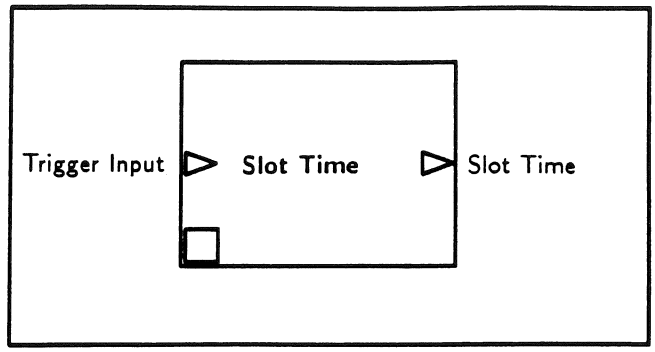
The length of each slot in bytes.

Name and Type: Prob. for Geometric Rangen REAL

Description:

This is the probability for Geometric Ranges to generate the number of cells for the time interval ($Prob = \frac{1}{Mean\ Number\ of\ Cells}$).

Slot Time



Description

This module calculates the unit slot time for discrete time system. The information needed are transmission rate and slot length.

I/O Pads

INPUT SIGNALS:

Name and Type: Trigger Input TRIGGER

Description:

The input triggers the calculation of the unit slot time in seconds.

OUTPUT SIGNALS:

Name and Type: Slot Time REAL

Description:

Slot time in seconds.

Parameters

Name and Type: Transmission Rate (bits/sec.) REAL

Description:

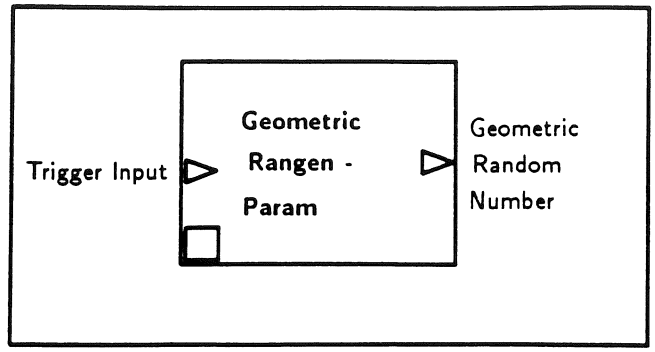
Transmission rate of the network in bits/second.

Name and Type: Slot Length (bytes) REAL

Description:

The length of each slot in bytes.

Geometric Rangen - Param



Description

This module generates a geometrically distributed random number according to the success probability parameter, set by the user, and the formula $\frac{\ln U(0,1)}{\ln(1-p)}$.

I/O Pads

INPUT SIGNALS:

Name and Type: Trigger Input TRIGGER

Description:

This signal triggers the generation of the Geometric Random Number.

OUTPUT SIGNALS:

Name and Type: Geometric Random Number INTEGER

Description:

The output of the generator. This number is geometrically distributed.

Parameters

Name and Type: Probability for Geometric Rangen REAL

Description:

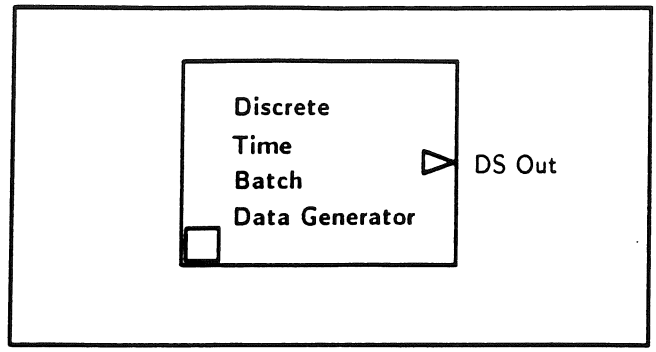
This is the success probability for Geometric Random Number Generator.

2.2 Discrete Time Batch Data Generator

Modules in this section

- Discrete Time Batch Data Generator
- Batch Arrival

Discrete Time Batch Data Generator



Description

This module is a Discrete Time traffic generator for batch data arrivals which generates a series of trigger signals with a Geometrically distributed inter-batch time and Poisson distributed batch size.

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: DS Out COMPOSITE

Description:

Output data cells are emitted with Poisson Batch Arrival with Geometric inter-batch arrival.

Parameters

Name and Type: Prob. for Geometric Rangen REAL

Description:

This is the probability for Geometric Rangen to generate the number of cells for the time interval ($Prob = \frac{1}{Mean\ Number\ of\ Cells}$).

Name and Type: Mean Number of Batch Arrival Cells REAL

Description:

This is the Mean Number of Cells generated by this generator.

Name and Type: Seed for Batch Arrival Generator INTEGER

Description:

This is a Seed for Poisson Rangen - Param in batch Arrival module.

Name and Type: Queue Size for Batch Arrival Generator INTEGER

Description:

Queue size to hold the arrival signals.

Name and Type: Transmission Rate (bits/sec.) REAL

Description:

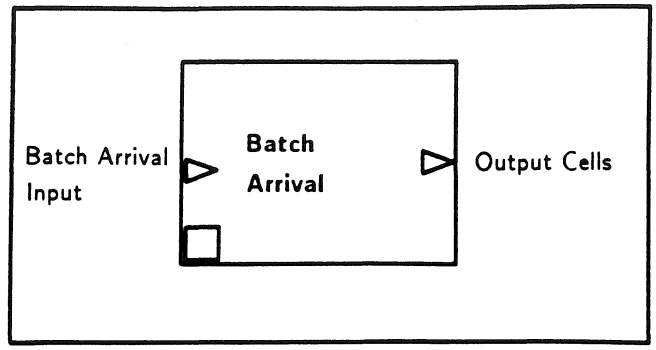
Transmission rate of the network in bits/second.

Name and Type: Slot Length (bytes) REAL

Description:

The length of each slot in bytes.

Batch Arrival



Description

This module generates batch data. The number of cells is generated according to a Poisson distribution.

I/O Pads

INPUT SIGNALS:

Name and Type: Batch Arrival Input COMPOSITE

Description:

The input triggers the Batch Arrival generator.

OUTPUT SIGNALS:

Name and Type: Output Cells COMPOSITE

Description:

Output data cells from the Batch Arrival generator (one output signal per cell).

Parameters

Name and Type: Mean Number of Batch Arrival Cells REAL

Description:

This is the mean number of cells generated by the Batch Arrival generator.

Name and Type: Seed for Batch Arrival Generator INTEGER

Description:

This is the seed for Poisson Rangen - Param random number generator used in the module.

Name and Type: Queue Size for Batch Arrival Generator INTEGER

Description:

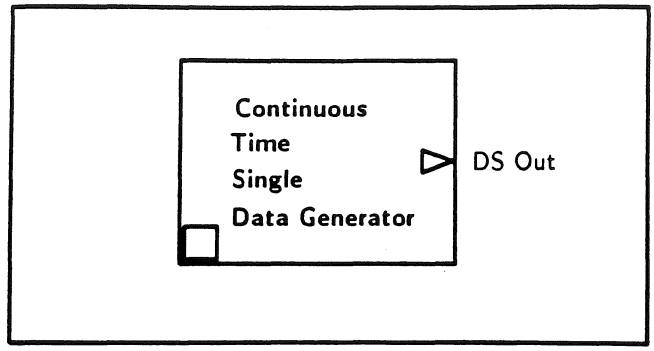
Queue size to hold the signal arrivals.

2.3 Continuous Time Single Data Generator

Modules in this section

- Continuous Time Single Data generator
- Continuous Time Pulse Train

Continuous Time Single Data generator



Description

This module is a Continuous Time Traffic Generator for single data arrivals which generates a series of trigger signals with an exponentially distributed inter-pulse time.

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: DS Out COMPOSITE

Description:

Output data cells are emitted with Poisson interarrivals.

Parameters

Name and Type: Interarrival Seed INTEGER

Description:

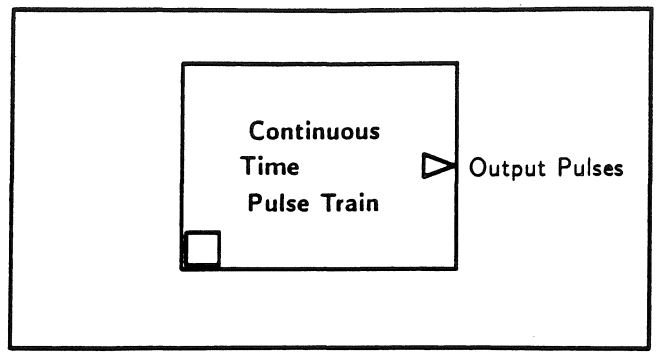
The seed is used for interarrivals.

Name and Type: Interarrival Mean REAL

Description:

The mean time between interarrivals.

Continuous Time Pulse Train



Description

This module generates a series of signals with an exponentially distributed inter-pulse time. The first output occurs when the simulation clock value equals the value of the Exp Pulse Init Time parameter. After this first pulse, the time between pulses is an exponentially distributed random variable with a mean value set by the parameter Exp Pulse Mean. This module was created by copying the Poisson Pulse Train module in BONeS database "Simple Example".

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: Output Pulses TRIGGER

Description:

Output which is triggered at random times according to the parameters.

Parameters

Name and Type: Exp Pulse Seed INTEGER

Description:

Seed for the Exponential Random Generator which generates the time between pulses.

Name and Type: Exp Pulse Mean REAL

Description:

The mean value between pulses (after the Init time).

Name and Type: Exp Pulse Init Time REAL

Description:

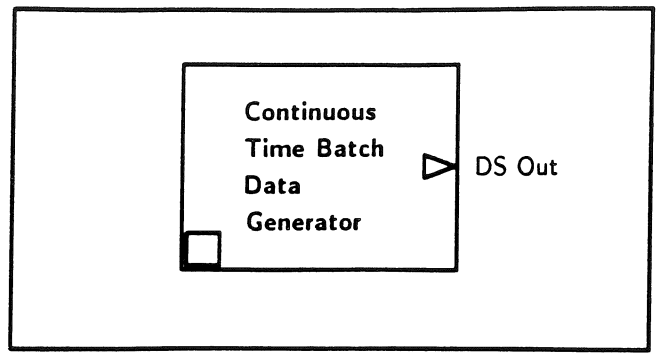
Delay before the first pulse is sent to output.

2.4 Continuous Time Batch Data Generator

Modules in this section

- Continuous Time Batch Data Generator

Continuous Time Batch Data Generator



Description

This module is a Continuous Time Traffic Generator for Batch Data Arrival which generates a series of trigger signals with an Exponentially distributed inter-batch time and Poisson distributed batch size.

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: DS Out COMPOSITE

Description:

Output data structures are emitted with Poisson Batch Arrival with Poisson inter-batch arrival.

Parameters

Name and Type: Mean number of Batch Arrival Cells REAL

Description:

This is the Mean Number of Cells generated by Batch Arrival Generator.

Name and Type: Seed for Batch Arrival Generator INTEGER

Description:

This is a Seed for Poisson Rangen - Param in Batch Arrival module.

Name and Type: Queue size for Batch Arrival Generator INTEGER

Description:

Queue size to hold the arrival signals.

Name and Type: Interarrival Seed INTEGER

Description:

This seed is used for interarrivals.

Name and Type: Interarrival Mean REAL

Description:

The mean time between interarrivals.

3 Voice Sources

The correlated generation of voice cells within a call is implemented by an Interrupted Poisson Process (IPP) or by a Markov Modulated Poisson Process (MMPP). The following voice traffic generators are included in this release:

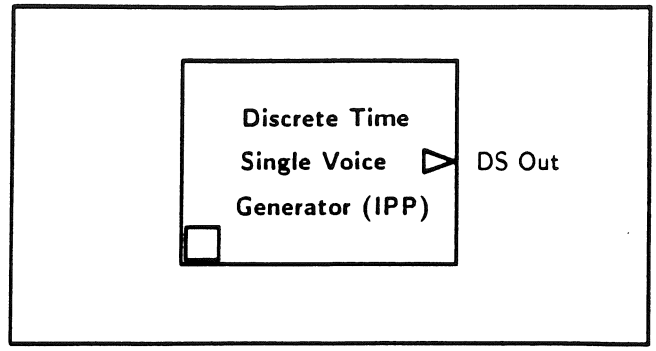
1. Discrete Time Single Voice Generator (IPP)
2. Discrete Time Multiple Voice Generator (IPP)
3. Discrete Time Multiple Voice Generator (MMPP)
4. Continuous Time Single Voice Generator (IPP)
5. Continuous Time Multiple Voice Generator (IPP)
6. Continuous Time Multiple Voice Generator (MMPP)

3.1 Discrete Time Single Voice Generator (IPP)

Modules in this section

- Discrete Time Single Voice Generator (IPP)
- Discrete Time IPP Pulse Train
- Discrete Time Silence
- Discrete Time Talk Spurt

Discrete Time Single Voice Generator (IPP)



Description

This module is a Discrete Time Traffic Generator for single voice arrivals, generating a series of trigger signals according to the Interrupted Poisson Process (IPP) model.

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: DS Out COMPOSITE

Description:

Output voice cells.

Parameters

Name and Type: Prob. for Geometric Rangen for Silence Period REAL

Description:

This is the probability for the Geometric Rangen generator to generate the number of slots in silence periods ($Prob = \frac{1}{Mean\ Number\ of\ Slots}$).

Name and Type: Prob. for Geometric Rangen for Talk Spurt Period REAL

Description:

This is the probability for the Geometric Rangen to generate the number of slots in talk spurt periods ($Prob = \frac{1}{Mean\ Number\ of\ Slots}$).

Name and Type: Prob. for Bernoulli Rangen REAL

Description:

This is the probability that the next slot is a talk.

Name and Type: Transmission Rate (bits/sec.) REAL

Description:

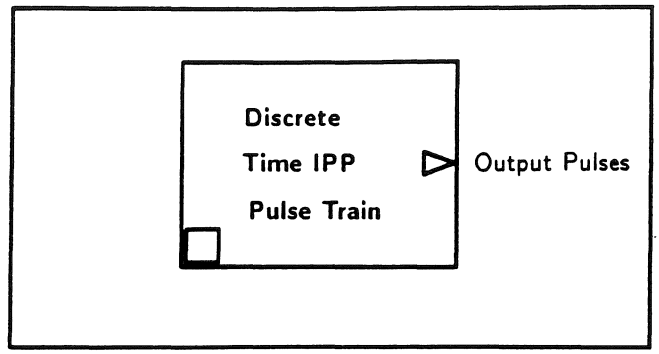
Transmission rate of the network in bits/second.

Name and Type: Slot Length (bytes) REAL

Description:

The length of each slot in bytes.

Discrete Time IPP Pulse Train



Description

This module generates a series of Talk spurt and Silence periods with Geometric distribution. Within a Talk Spurt, this module generates a series of pulses for voice cells according to the Bernoulli distribution. This module assumes that the initial status is Talk Spurt.

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: Output Pulses TRIGGER

Description:

Output which is triggered at random time according to the parameters.

Parameters

Name and Type: Prob. for Geometric Rangen for Silence Period REAL

Description:

This is the probability for geometric rangen to generate the number of slots for the silence periods ($Prob = \frac{1}{Mean\ Number\ of\ Slots}$).

Name and Type: Prob. for Geometric Rangen for Talk Spurt Period REAL

Description:

This is the probability for the Geometric Rangen generator to generate the number of slots in talk spurt periods ($Prob = \frac{1}{Mean\ Number\ of\ Slots}$).

Name and Type: Prob. for Bernoulli Rangen REAL

Description:

This is the probability that the next slot is a talk.

Name and Type: Transmission Rate (bits/sec.) REAL

Description:

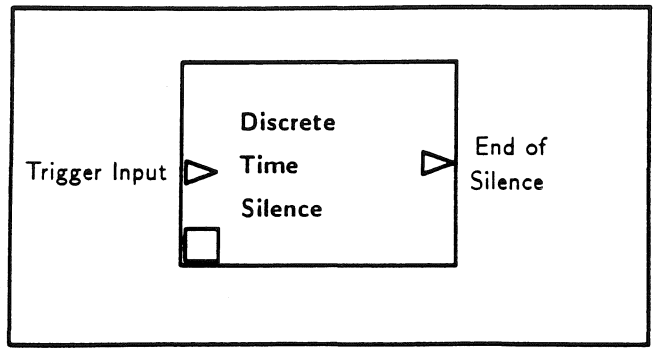
Transmission rate of the network in bits/second.

Name and Type: Slot Length (bytes) REAL

Description:

The length of each slot in bytes.

Discrete Time Silence



Description

This module generates the silence periods in discrete time.

I/O Pads

INPUT SIGNALS:

Name and Type: Trigger Input TRIGGER

Description:

This Input triggers the generation of silence periods.

OUTPUT SIGNALS:

Name and Type: End of Silence TRIGGER

Description:

This signal generates a pulse when a silence period finishes, which, in turn, triggers the generation of a talk spurt.

Parameters

Name and Type: Prob. for Geometric Rangen REAL

Description:

This is the probability for the Geometric Rangen generator to generate the number of slots in silence periods ($Prob = \frac{1}{Mean\ Number\ of\ Slots}$).

Name and Type: Transmission Rate (bits/sec.) REAL

Description:

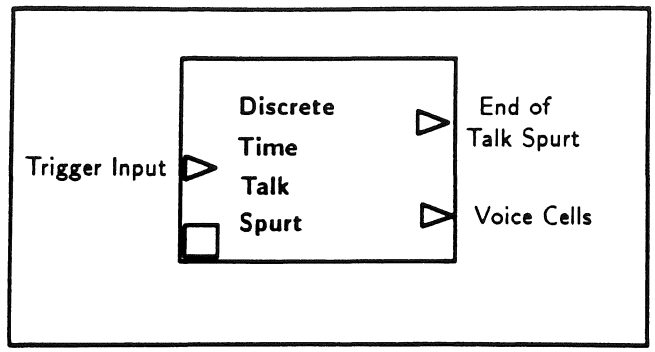
Transmission rate of the network in bits/second.

Name and Type: Slot Length (bytes) REAL

Description:

The Length of each slot in bytes.

Discrete Time Talk Spurt



Description

This module generates the talk spurt periods and the voice cells for discrete time voice input. A geometrically distributed random number is generated which is the length (in slots) of the talk spurt. Each slot can be a talk or silence, which is determined by the Bernoulli random number.

I/O Pads

INPUT SIGNALS:

Name and Type: Trigger Input TRIGGER

Description:

This input triggers the generation of talk spurts.

OUTPUT SIGNALS:

Name and Type: End of Talk Spurt TRIGGER

Description:

This signal is enabled at the end of a talk spurt, which, in turn, triggers the generation of a silent period. In MMPP model, this signal triggers the next talk spurt.

Name and Type: Voice Cells TRIGGER

Description:

Output pulses for discrete time voice traffic cells.

Parameters

Name and Type: Prob. for Bernoulli Rangen REAL

Description:

Probability that the next slot is a talk. This is a real constant value in [0,1]. It is also served as the percentage of talk cells within the talk spurt (e.g., if the probability is 0.8, then 80% of the slots are talk).

Name and Type: Prob. for Geometric Rangen REAL

Description:

This is the probability for the Geometric Rangen generator to generate the mean number of slots for a talk spurt ($Prob = \frac{1}{Mean\ Number\ of\ Slots}$).

Name and Type: Transmission Rate (bits/sec.) REAL

Description:

Transmission rate of the network in bits/second.

Name and Type: Slot Length (bytes) REAL

Description:

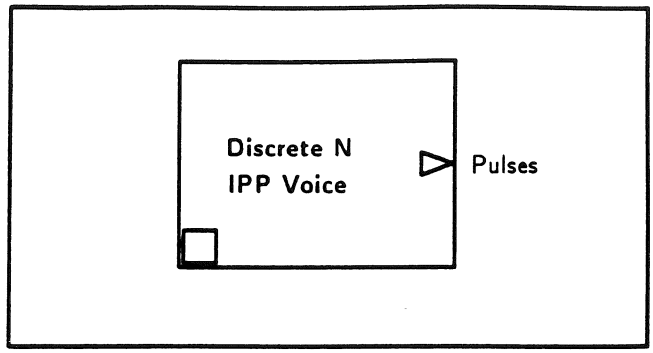
The length of each slot in bytes.

3.2 Discrete Time Multiple Voice Generator (IPP)

Modules in this section

- Discrete N IPP Voice
- Compute Probability Table
- Compute Active Users
- Voice Packets Generation
- Pn (eq. 1)

Discrete N IPP Voice



Description

This module is a voice generator generating pulses for a system with N voice users. The module follows the Interrupted Poisson Process (IPP) model.

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: Pulses TRIGGER

Description:

The number of pulses generated by the Discrete N IPP Voice generator.

Parameters

Name and Type: Alpha REAL

Description:

The transition probability from OFF to ON.

Name and Type: Beta REAL

Description:

The transition probability from ON to OFF.

Name and Type: N INTEGER

Description:

Number of voice users in the system.

Name and Type: Slot Length REAL

Description:

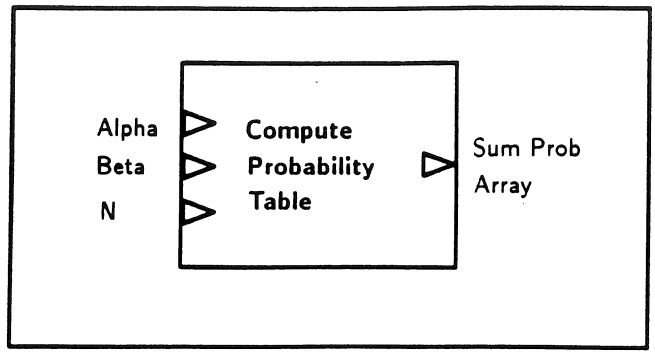
Length of a slot (bytes)

Name and Type: Transmission Rate REAL

Description:

Channel speed (bits/sec.)

Compute Probability Table



Description

This module computes the probability table in which each table entry n is the sum of the previous entry $n-1$ and the probability P_n using the following formula:

$$P_n = \left(\begin{array}{c} N \\ n \end{array} \right) (\frac{\alpha}{\alpha+\beta})^n (\frac{\beta}{\alpha+\beta})^{(N-n)} \qquad for\ 0 \leq n \leq N.$$

I/O Pads

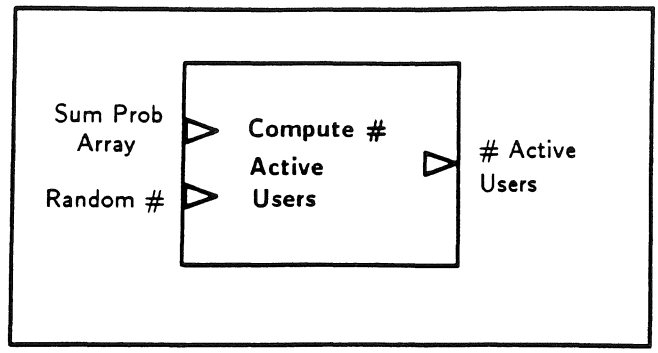
INPUT SIGNALS:

Name and Type:	Alpha	REAL
Description:		
The transition probability from OFF to ON.		
Name and Type:	Beta	REAL
Description:		
The transition probability from ON to OFF.		
Name and Type:	N	INTEGER
Description:		
Number of voice users in the system.		

OUTPUT SIGNALS:

Name and Type:	Sum Prob Array	REAL-VECTOR
Description:		
The probability table.		

Compute Active Users



Description

Given a random number, this module calculates the number of active users.

I/O Pads

INPUT SIGNALS:

Name and Type: Sum Prob Array REAL-VECTOR

Description:

The probability table.

Name and Type: Random # REAL

Description:

A random number.

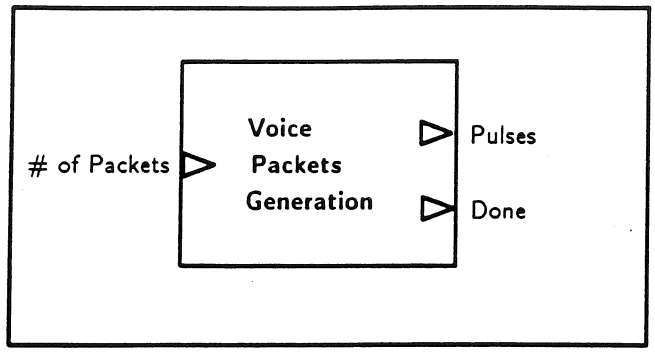
OUTPUT SIGNALS:

Name and Type: # Active Users INTEGER

Description:

Number of active users.

Voice Packets Generation



Description

This module generates N number of packet pulses.

I/O Pads

INPUT SIGNALS:

Name and Type: # of Packets INTEGER

Description:

The number of packets to be generated.

OUTPUT SIGNALS:

Name and Type: Pulses TRIGGER

Description:

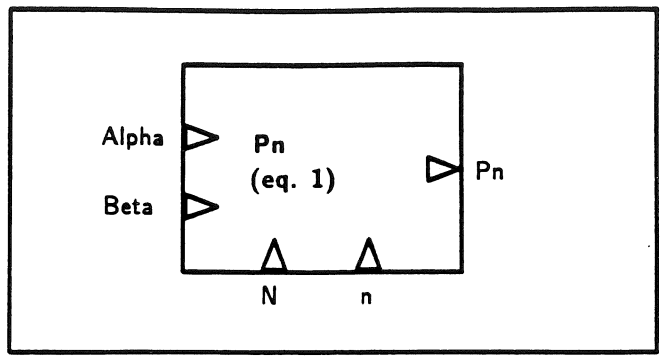
Pulses corresponding to the number of packets.

Name and Type: Done TRIGGER

Description:

Signal indicating the generator has finished generating packets for the current random number.

Pn (eq. 1)



Description

This module implements the equation:

$$P_n = \binom{N}{n} \left(\frac{\alpha}{\alpha+\beta}\right)^n \left(\frac{\beta}{\alpha+\beta}\right)^{(N-n)} \qquad for\ 0 \leq n \leq N.$$

I/O Pads

INPUT SIGNALS:

Name and Type: Alpha REAL

Description:

The transition probability from OFF to ON.

Name and Type: Beta REAL

Description:

The transition probability from ON to OFF.

Name and Type: N INTEGER

Description:

Number of voice users in the system.

Name and Type: n INTEGER

Description:

Number of voice users to be active.

OUTPUT SIGNALS:

Name and Type: Pn REAL

Description:

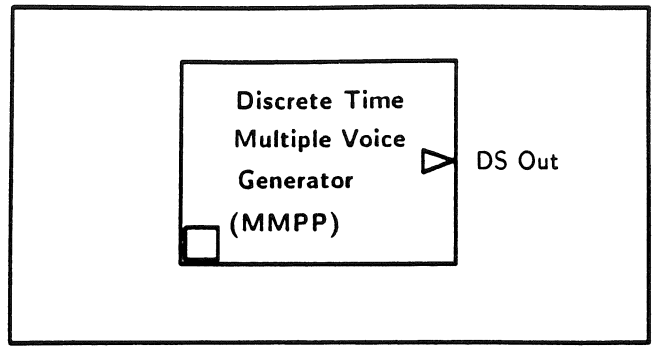
The probability that n users is active.

3.3 Discrete Time Multiple Voice Generator (MMPP)

Modules in this section

- Discrete Time Multiple Voice Generator (MMPP)
- Discrete Time MMPP Pulse Train

Discrete Time Multiple Voice Generator (MMPP)



Description

This traffic generator module generates a series of voice cells according to the MMPP model.

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: DS Out COMPOSITE

Description:

Voice cells are generated.

Parameters

Name and Type: Prob. for Bernoulli Rangen 1 REAL

Description:

The probability that the nest slot is a talk during state 1.

Name and Type: Prob. for Bernoulli Rangen 2 REAL

Description:

The probability that the next slot is a talk during state 2.

Name and Type: Prob. for Geometric Rangen 1 REAL

Description:

1/Mean Number of slots during state 1.

Name and Type: Prob. for Geometric Rangen 2 REAL

Description:

1/Mean number of slots in state 2.

Name and Type: Transmission Rate (bits/sec.) REAL

Description:

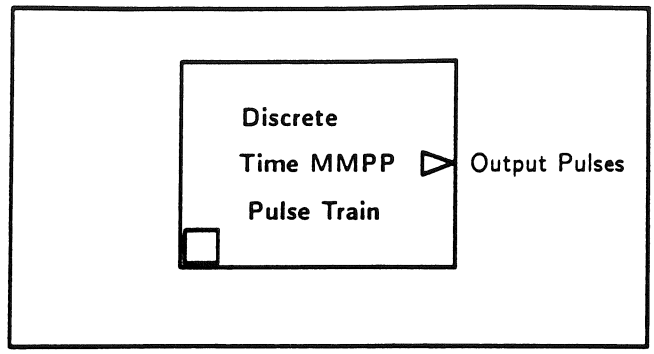
Transmission rate of the network in bits/second.

Name and Type: Slot Length (bytes) REAL

Description:

The length of each slot in bytes.

Discrete Time MMPP Pulse Train



Description

This module simulates multiple voice sources following the two state Markov Modulated Poisson Process (MMPP) model in discrete time. The duration of each state follows a geometric distribution. Within a Talk Spurt, this module generates a series of pulses for voice slots according to the Bernoulli distribution. For each slot, N pulses are output to simulate voice cells from N voice sources.

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: Output Pulses TRIGGER

Description:

The output signals according to the MMPP model.

Parameters

Name and Type: Prob. for Bernoulli Rangen 1 REAL

Description:

The probability that the nest slot is a talk during state 1.

Name and Type: Prob. for Bernoulli Rangen 2 REAL

Description:

The probability that the next slot is a talk during state 2.

Name and Type: Prob. for Geometric Rangen 1 REAL

Description:

1/Mean Number of slots during state 1.

Name and Type: Prob. for Geometric Rangen 2 REAL

Description:

1/Mean number of slots in state 2.

Name and Type: Transmission Rate (bits/sec.) REAL

Description:

Transmission rate of the network in bits/second.

Name and Type: Slot Length (bytes) REAL

Description:

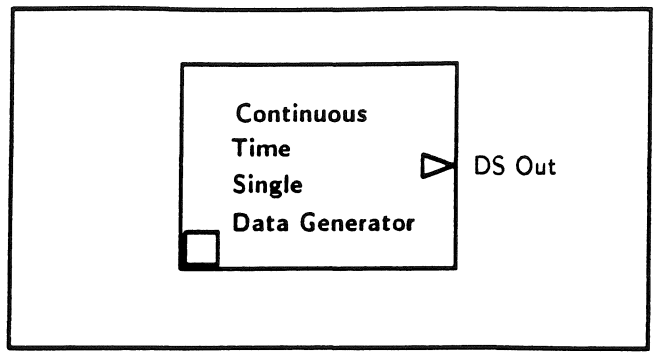
The length of each slot in bytes.

3.4 Continuous Time Single Voice Generator (IPP)

Modules in this section

- Continuous Time Single Data Generator
- Continuous Time IPP Pulse Train
- Continuous Time Talk Spurt
- Continuous Time Silence

Continuous Time Single Data Generator



Description

This module is a Continuous Time Traffic Generator for single data arrivals which generates a series of trigger signals with an exponentially distributed inter-pulse time.

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: DS Out COMPOSITE

Description:

Output data cells are emitted with Poisson interarrivals.

Parameters

Name and Type: Interarrival Seed INTEGER

Description:

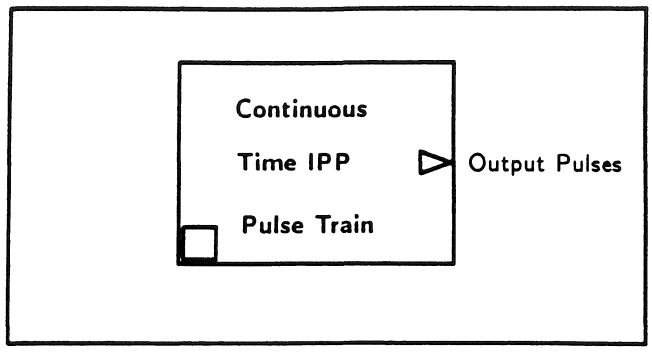
The seed is used for interarrivals.

Name and Type: Interarrival Mean REAL

Description:

The mean time between interarrivals.

Continuous Time IPP Pulse Train



Description

This module generates voice cells according to the IPP model in continuous time.

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: Output Pulses TRIGGER

Description:

Output signals for voice cells generated.

Parameters

Name and Type: Prob. for Bernoulli Rangen (Prob. of Next Slot is Talk) REAL

Description:

Real constant value used for comparison.

Name and Type: Mean Talk Spurt REAL

Description:

Mean length of a talk period.

Name and Type: Mean Silence REAL

Description:

Mean length of a silence period.

Name and Type: Transmission Rate (bits/sec.) REAL

Description:

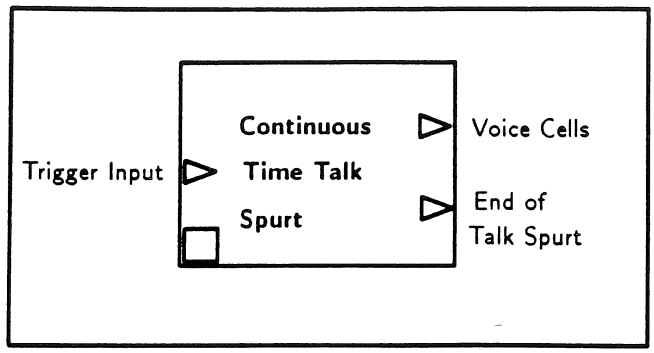
Transmission rate of the network in bits/second.

Name and Type: Slot Length (bytes) REAL

Description:

The Length of each slot in bytes.

Continuous Time Talk Spurt



Description

This module generates an exponentially distributed random number which is the length in seconds of the talk spurt in continuous time case. Within the talk spurt are slots which can be talk or silence. The probability that the current slot is a talk follows a Bernoulli distribution.

I/O Pads

INPUT SIGNALS:

Name and Type: Trigger Input TRIGGER

Description:

This input triggers the generation of a talk spurt (period of talk slots).

OUTPUT SIGNALS:

Name and Type: Voice Cells TRIGGER

Description:

Output pulses for continuous time voice traffic cells.

Name and Type: End of Talk Spurt TRIGGER

Description:

This signal is enabled at the end of the talk spurt, which in turn, triggers the silent period. In MMPP model, this signal triggers the next talk spurt.

Parameters

Name and Type: Prob. for Bernoulli Rangen REAL

Description:

Probability that the next slot is a talk. This is a real constant value in [0,1]. It is also served as the percentage of talk cells within the talk spurt (e.g., if the probability is 0.8, then 80% of the slots are talk).

Name and Type: Mean Talk Spurt REAL

Description:

Mean length of a talk spurt (in seconds).

Name and Type: Transmission Rate (bits/sec.) REAL

Description:

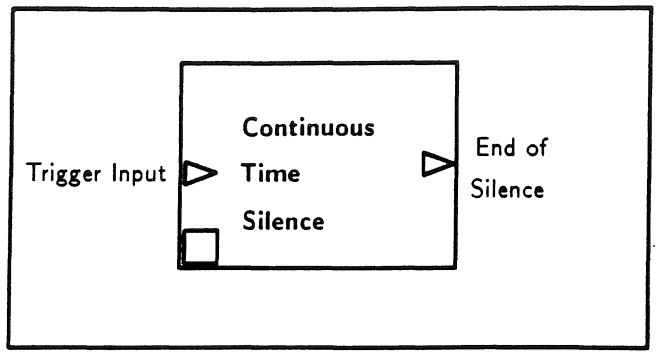
Transmission rate of the network in bits/second.

Name and Type: Slot Length (bytes) REAL

Description:

The length of each slot in bytes.

Continuous Time Silence



Description

This module generates the silence period for the continuous time case.

I/O Pads

INPUT SIGNALS:

Name and Type: Trigger Input TRIGGER

Description:

The trigger from Continuous Time Talk Spurt enables this module.

OUTPUT SIGNALS:

Name and Type: End of Silence TRIGGER

Description:

The signal indicates the end of a silence period, which, in turn, enables the generation of a talk spurt.

Parameters

Name and Type: Mean Silence REAL

Description:

Mean length of a silence period.

3.5 Continuous Time Multiple Voice Generator (IPP)

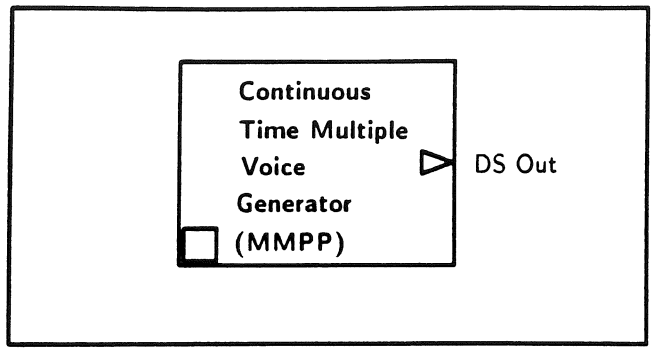
This model has the same behavior as model B of video sources when $N = M$ and $A = 1$. For more information, please refer to the survey paper of Bae and Suda.

3.6 Continuous Time Multiple Voice Generator (MMPP)

Modules in this section

- Continuous Time Multiple Voice Generator (MMPP)
- Continuous Time MMPP Pulse Train

Continuous Time Multiple Voice Generator (MMPP)



Description

This module is a continuous time traffic generator to simulate multiple voice sources. It generates voice cells according to the MMPP model.

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: DS Out COMPOSITE
Description:
Output voice cells are generated.

Parameters

Name and Type: Bernoulli Prob. State 2 REAL
Description:
The Probability that the next slot is a talk while in state 2.

Name and Type: Bernoulli Prob. State 1 REAL
Description:
The Probability that the next slot is a talk while in state 1.

Name and Type: Mean Length State 1 REAL
Description:
Mean length of state 1 (in seconds).

Name and Type: Mean Length State 2 REAL
Description:
Mean length of state 2 (in seconds).

Name and Type: N State 1 INTEGER
Description:
Number of pulses per talk slot in state 1. This is a constant value.

Name and Type: N State 2 INTEGER
Description:
Number of pulses per talk slot in state 2. This is a constant value.

Name and Type: Transmission rate (bits/sec.) REAL
Description:

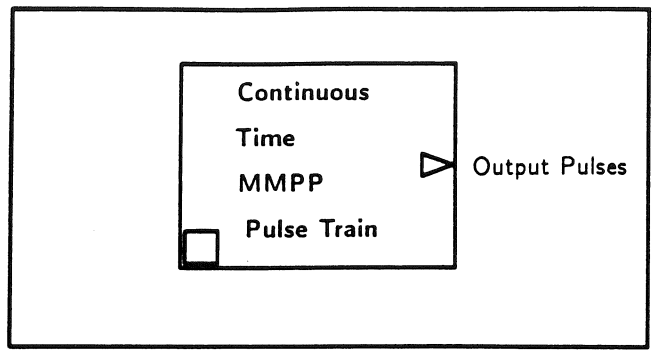
Transmission rate of the network in bits/second.

Name and Type: Slot Length (bytes) REAL

Description:

The length of each slot in bytes.

Continuous Time MMPP Pulse Train



Description

This module generates voice cells, simulating the two-state Markov Modulated Poisson Process (MMPP) for N aggregated voice sources in continuous time. There are two states, 1 and 2, each of which is simulated by a Continuous Time Talk Spurt module which outputs a pulse for every slot containing a talk. For each talk slot, N pulses are generated to simulate N voice sources. The end of state 1 triggers the beginning of state 2, and vice-versa.

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: Output Pulses TRIGGER

Description:

The output signals according to the MMPP model.

Parameters

Name and Type: Bernoulli Prob. State 2 REAL

Description:

The probability that the next slot is a talk while in state 2.

Name and Type: Bernoulli Prob. State 1 REAL

Description:

The probability that the next slot is a talk while in state 1.

Name and Type: Mean Length State 1 REAL

Description:

The mean length of state 1 (in seconds).

Name and Type: Mean Length State 2 REAL

Description:

The mean length of state 2 (in seconds).

Name and Type: Transmission rate (bits/sec.) REAL

Description:

Transmission rate of the network in bits/second.

Name and Type: Slot length (bytes) REAL

Description:

The length of each slot in bytes.

4 Video Sources

The following video traffic generators are included in this release:

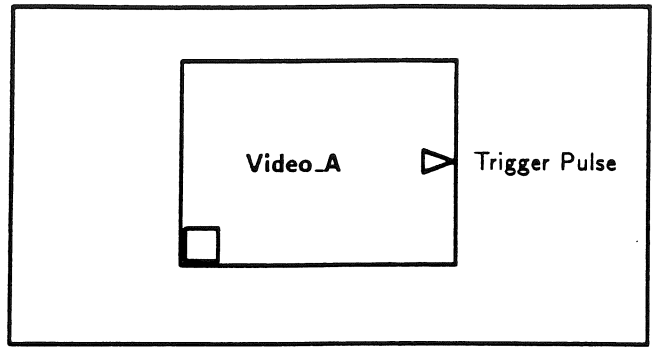
1. Model A: Continuous-State First-Order Autoregressive Markov model – single video source without scene change
2. Model B: Discrete-State Continuous-Time Markov process – aggregated arrival process from N video sources without scene change
3. Model C: Discrete-State Continuous-Time Markov process with scene change – aggregated arrival process from N video sources with scene change (Extension of Model B)
4. Model D: Discrete-State Continuous-Time Markov Process with Batch Arrivals – Aggregated arrival process from N video sources with scene change

4.1 Model A: Continuous-State First-Order Autoregressive Markov Model

Modules in this section

- Video_A
- Number of Cells/Sec Generator
- First-Order Autoregressive Markov Model

Video_A



Description

This video traffic generator models video sources without scene changes using the continuous-state, autoregressive Markov model (Model A).

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: Trigger Pulse TRIGGER

Description:

This is the output video stream.

Parameters

Name and Type: Delay Time for One Frame REAL

Description:

The delay time for one frame. 1/30 of a sec. or other given values.

Name and Type: Number of Bytes/Cell REAL

Description:

Number of bytes contained in one cell.

Name and Type: Mu REAL

Description:

Mu represents the mean of the Gaussian random process or also of the Normal Distribution.

Name and Type: b REAL

Description:

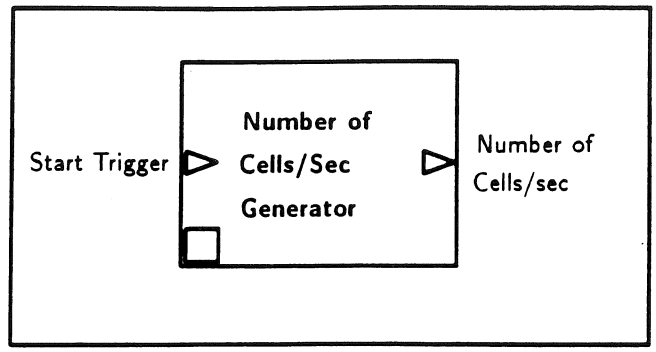
Coefficient of the Gaussian random process.

Name and Type: a1 REAL

Description:

Coefficient of the source bit rate.

Number of Cells/Sec Generator



Description

This module computes the number of cells per second using the frame bit rate.

I/O Pads

INPUT SIGNALS:

Name and Type: Start Trigger TRIGGER

Description:

Signal for triggering the start of the module.

OUTPUT SIGNALS:

Name and Type: Number of Cells/sec. INTEGER

Description:

Number of cells generated per second.

Parameters

Name and Type: Number of Bytes/cell REAL

Description:

Number of bytes per cell.

Name and Type: Mu REAL

Description:

Mu represents the mean of the Gaussian random process or also of the Normal Distribution.

Name and Type: b REAL

Description:

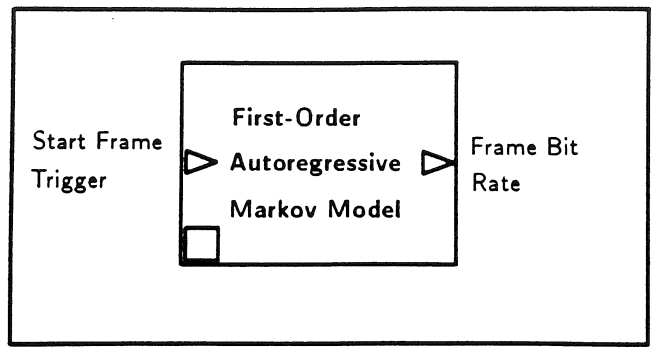
Coefficient of the Gaussian random process.

Name and Type: a1 REAL

Description:

Coefficient of the source bit rate.

First-Order Autoregressive Markov Model



Description

This module implements the First-Order Autoregressive Markov model of the video source.

I/O Pads

INPUT SIGNALS:

Name and Type: Start Frame Trigger TRIGGER

Description:

The Trigger is used to start the simulation and continue next frame.

OUTPUT SIGNALS:

Name and Type: Frame Bit Rate REAL

Description:

Number of bits per frame.

Parameters

Name and Type: b REAL

Description:

Coefficient of the Guassian random process.

Name and Type: a1 REAL

Description:

Coefficient of the source bit rate.

Name and Type: Mu REAL

Description:

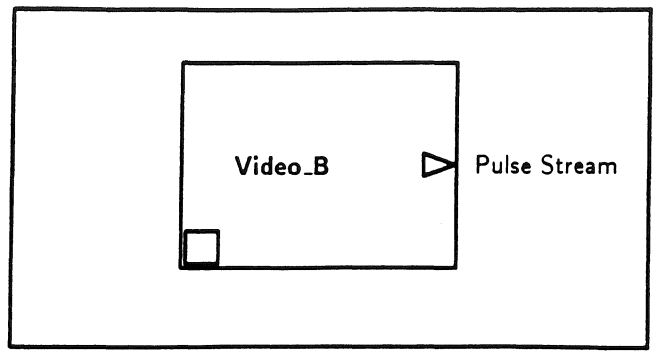
Mu represents the mean of the Gaussian random process or also of the Normal Distribution.

4.2 Model B: Discrete-State Continuous-Time Markov Process

Modules in this section

- Video_B
- DFA For Video B
- No Init Constant Stream
- Gated V/Rate One Shot (Poisson)
- Gated Poisson One-Shot

Video_B



Description

This video traffic generator models video sources with no scene changes using the discrete-state, continuous-time Markov process model (Model B).

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: Pulse Stream TRIGGER
Description:
This is the output video stream.

Parameters

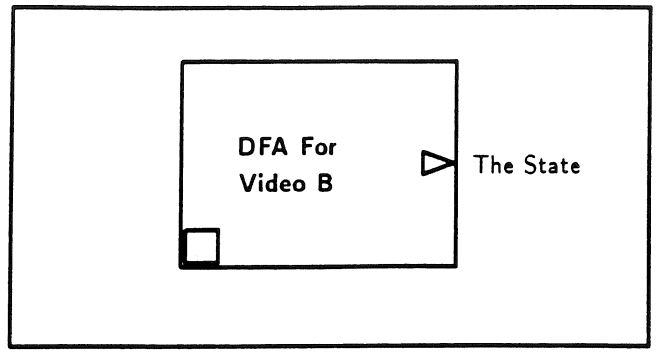
Name and Type: A REAL
Description:
This is the basic rate of output.

Name and Type: Beta REAL
Description:
This is the rate at which the traffic intensity decreases.

Name and Type: Alpha REAL
Description:
This is the ALPHA rate at which the traffic intensity increases.

Name and Type: M INTEGER
Description:
This is the number of possible states (-1) that can be assumed.

DFA For Video B



Description

This module simulates the deterministic finite automata for the discrete-state, continuous-time Markov process model (Model B).

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: The State INTEGER

Description:

This is the output data stream.

Parameters

Name and Type: Beta REAL

Description:

This is the rate at which the rate decreases.

Name and Type: Alpha REAL

Description:

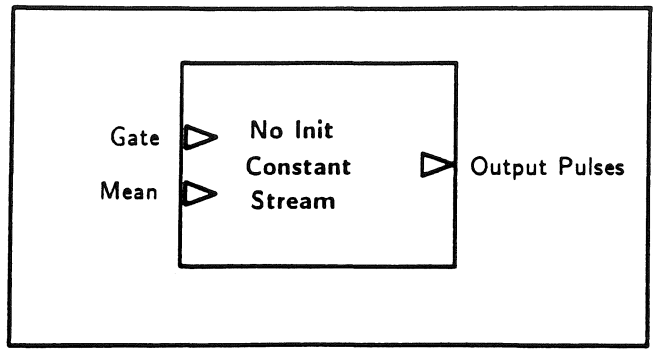
This is the rate at which the rate increases.

Name and Type: M INTEGER

Description:

This is the number of possible states (-1) that can be assumed.

No Init Constant Stream



Description

This module generates a series of signals with constant inter-pulse time. The first output occurs when the simulation clock value equals the value of the Exp Pulse Init Time parameter. After this first pulse, the time between pulses is an exponentially distributed random variable with a mean value read from the input MEAN. Exp Pulse seed parameter is set to -1 , so that its value is dependent on the Global Seed, set when starting a simulation. Consult the BONes User's Guide and Reference Manual for more information on random generator seeds.

I/O Pads

INPUT SIGNALS:

Name and Type: Mean REAL

Description:

This is the interarrival rate.

Name and Type: Gate INTEGER

Description:

This turns the stream on and off.

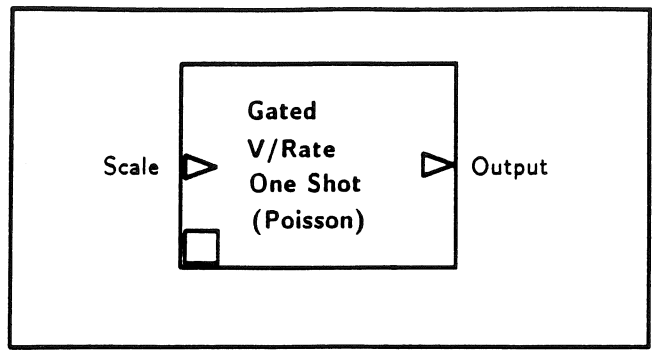
OUTPUT SIGNALS:

Name and Type: Output Pulses TRIGGER

Description:

Output which is triggered at random times according to the parameters.

Gated V/Rate One Shot (Poisson)



Description

This module generates signals with an exponential interarrival time proportional to the input value 'scale'.

I/O Pads

INPUT SIGNALS:

Name and Type: Scale REAL

Description:

This is used to scale the rate.

OUTPUT SIGNALS:

Name and Type: Output TRIGGER

Description:

This is the output data stream.

Parameters

Name and Type: Base Rate REAL

Description:

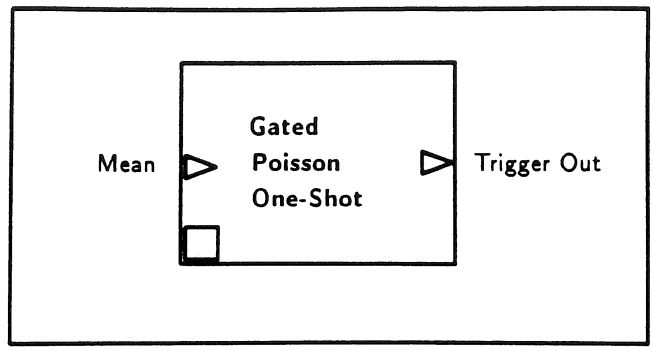
This is the base RATE which is multiplied by the SCALE input.

Name and Type: Exp Seed INTEGER

Description:

This is the seed used by the exponential random number generator.

Gated Poisson One-Shot



Description

This module generates a trigger signal with an exponentially distributed inter-pulse time.

I/O Pads

INPUT SIGNALS:

Name and Type: Mean REAL

Description:

This is the interarrival rate.

OUTPUT SIGNALS:

Name and Type: Trigger Out TRIGGER

Description:

Output which is triggered at a random time according to the parameters.

Parameters

Name and Type: Exp Seed INTEGER

Description:

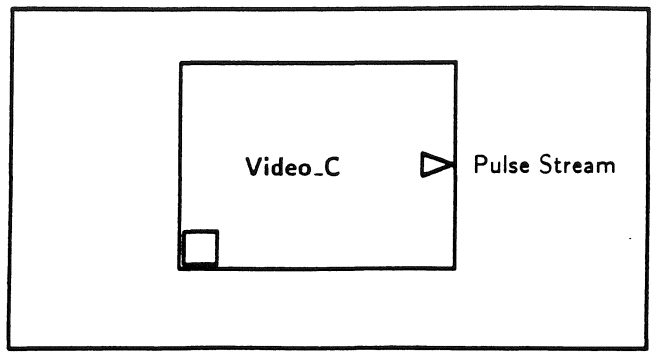
This is the seed used by the exponential random number generator.

4.3 Model C: Discrete-State Continuous-Time Markov Process With Scene Change

Modules in this section

- Video_C

Video_C



Description

This video traffic generator models video sources with scene changes using the discrete-state, continuous-time Markov process model (Model C).

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: Pulse stream TRIGGER

Description:

This is the output video stream.

Parameters

Name and Type: M1 INTEGER

Description:

The number of possible low activity states (-1) that can be assumed.

Name and Type: M2 INTEGER

Description:

The number of possible high activity states (-1) that can be assumed.

Name and Type: A_low REAL

Description:

This is the basic rate of low traffic activity states.

Name and Type: B REAL

Description:

This is the rate at which low traffic activity intensity decreases.

Name and Type: A REAL

Description:

This is the rate at which low traffic activity intensity increases.

Name and Type: A_high REAL

Description:

This is the basic rate of high traffic activity states.

Name and Type: D REAL

Description:

This is the rate at which high activity decreases.

Name and Type: C REAL

Description:

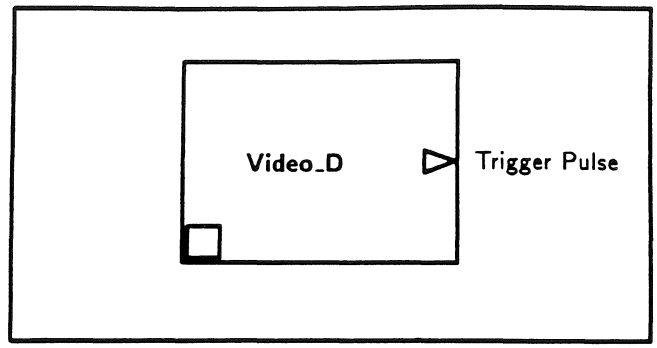
This is the rate at which high activity increases.

4.4 Model D: Discrete-State Continuous-Time Markov Process with Batch Arrivals

Modules in this section

- Video_D
- Batch Pulse Generator

Video_D



Description

This video traffic generator models video sources with scene changes using the discrete-state, continuous-time Markov process with batch arrivals model (Model D).

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: Trigger Pulses TRIGGER
Description:
A series of pulses generated by this module.

Parameters

Name and Type: Mean of Interarrival Time REAL
Description:
The mean delay between arrivals of batch of pulses.

Name and Type: Number of Cells INTEGER
Description:
The number of cells to be generated by this module.

Name and Type: Frame Length (seconds) REAL
Description:
The length of a frame in seconds.

Name and Type: A REAL
Description:
This is the basic rate of output.

Name and Type: Beta REAL
Description:
This is the BETA rate at which the traffic intensity decreases.

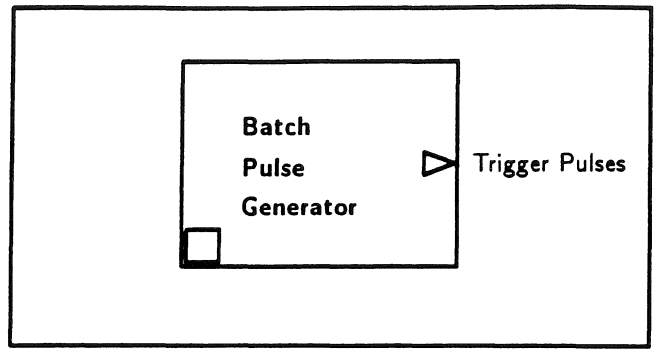
Name and Type: Alpha REAL
Description:
This is the ALPHA rate at which the traffic intensity increases.

Name and Type: M REAL

Description:

This is the the number of possible states (-1) that can be assumed.

Batch Pulse Generator



Description

This is a batch pulses generator for the video traffic generator "Video_D". This module generates inter-batch time with an exponential distribution, and generates pulses during one frame time. The batch size is a parameter.

I/O Pads

INPUT SIGNALS:

OUTPUT SIGNALS:

Name and Type: Trigger Pulses TRIGGER
Description:
Series of trigger pulses.

Parameters

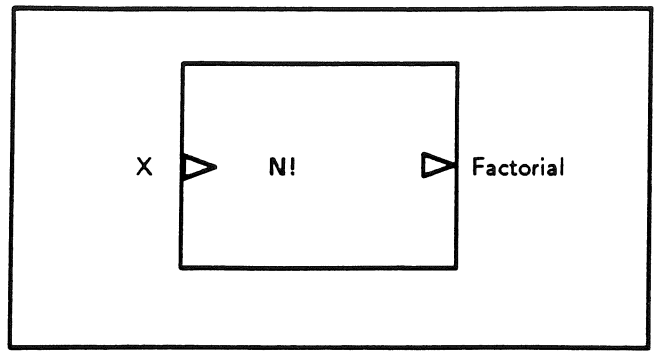
Name and Type: Mean of Interarrival Time REAL
Description:
Mean delay between the arrivals of batch of pulses.
Name and Type: Number of Cells INTEGER
Description:
Number of cells to be generated by this module.
Name and Type: Frame Length (seconds) REAL
Description:
Length of a frame in seconds.

5 Miscellaneous

Modules in this section

- Factorial
- Rceiling

Factorial



Description

This module computes the factorial of a number.

I/O Pads

INPUT SIGNALS:

Name and Type: X INTEGER

Description:

An integer number.

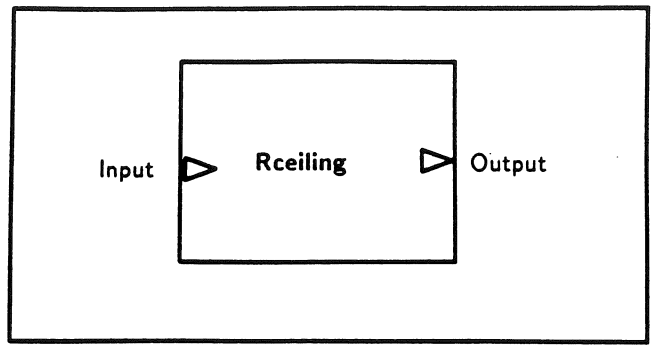
OUTPUT SIGNALS:

Name and Type: Factorial REAL

Description:

The factorial of the input number.

Rceiling



Description

This module computes the ceiling of a real number.

I/O Pads

INPUT SIGNALS:

Name and Type: Input REAL

Description:

Real number to be taken the ceiling of.

OUTPUT SIGNALS:

Name and Type: Output INTEGER

Description:

The ceiling of the input number.